

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:

Hatzigianni, M;Kalaitzidis, I

Title:

Early childhood educators' attitudes and beliefs around the use of touchscreen technologies by children under three years of age

Date:

2018-09-01

Citation:

Hatzigianni, M. & Kalaitzidis, I. (2018). Early childhood educators' attitudes and beliefs around the use of touchscreen technologies by children under three years of age. *British Journal of Educational Technology*, 49 (5), pp.883-895. <https://doi.org/10.1111/bjet.12649>.

Persistent Link:

<https://hdl.handle.net/11343/284551>

Authors: Maria Hatzigianni¹, Ioannis Kalaitzidis¹

Macquarie University Australia

Biographies

Maria Hatzigianni, PhD, is a Lecturer at the Department of Educational Studies, Macquarie University, Australia. Maria has published widely and her recent project focuses on the use of technology by very young children. Email: maria.hatzigianni@mq.edu.au Address: 29 Wally's Walk, room 239, Macquarie University, Sydney 2109, Australia.

Dr Ioannis Kalaitzidis is a cognitive psychologist working at Macquarie University as research associate and tutor. His main research interest involve working memory processes and the use of new technologies in dementia spectrum patients. Email: ioannis.kalaitzidis@mq.edu.au Address: AHH - 16 University Avenue, 2 North, Macquarie University, Sydney 2109, Australia.

Title: *'Early childhood educators' attitudes and beliefs around the use of touchscreen technologies by children under three years of age'.*

Abstract

This paper reports on an Australian study around early childhood educators' attitudes and beliefs on the use of touchscreen technologies by very young children, under three years of age. The study adopted an ecological perspective and educators and directors of early childhood centres completed an online survey and were interviewed on this specific topic. Data were analysed to identify teachers' competencies (e.g. digital skills) but also possible factors behind attitudes and beliefs (e.g. leadership styles; training; teaching philosophy). Findings suggest that early childhood teachers' views are evolving and they are now more confident when they use technology for work/personal purposes but not as confident when integrating technology with very young children. Educators' overall confidence and hours using technology is significantly associated with a positive attitude towards the incorporation of technology. Their teaching philosophy also associated with their technology use with very young children. In contrast, training or lack of it is not significant. This study has direct implications for Early Childhood Education as it will contribute to better understanding educators' views and practices on a hotly debated topic and whether they are ready to change their traditional views and embrace this new social reality. The need for more research on the influence of technological use on very young children's development will also be underlined.

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1111/bjet.12649](https://doi.org/10.1111/bjet.12649)

This article is protected by copyright. All rights reserved

Introduction

The use of touchscreen technologies (e.g. tablets and mobile phones) has grown immensely in recent years (Ahearne, Dilworth, Rollings, Livingstone, & Murray, 2015; Holloway, Green, & Stevenson, 2015). By the time many children reach three or four years of age, 96.6% can use mobile devices. Indeed, most start using them before they are one (Kabali et al., 2015). This growth in the use of touchscreen technologies has occurred despite strong recommendations from the American Academy of Pediatrics (AAP) (Strasburger et al., 2013) for children under the age of two to have no screen time, and for those over the age of two to have no more than two hours per day screen-based engagement. In 2014, Christakis proposed to rethink the AAP recommendation, as tablets are interactive and portable, enhance active participation and joint attention and children are able to make choices and take better control of their learning (p. 400).

Following Christakis' proposal, in 2016 AAP announced revised recommendations. For children under 18 months of age the current recommendation is to only engage in video calls for screen activity, and for children two to five years of age to engage with high quality programs for no more than an hour a day. Parents are also encouraged to co-view and interact with their children during screen activity to enhance learning opportunities through asking questions and building on children's vocabulary and understanding of concepts. Teachers can also benefit from research in this area and how educational applications are really 'educational', and not used just for entertainment purposes. Hirsh-Pasek, Zosh, Golinkoff, Gray, Robb, & Kaufman (2015) explain the four pillars of learning: active, engaging, meaningful and social learning which should be addressed by modern apps in order to satisfy the 'educational' label.

For those children who attend an early childhood (EC) setting, educators are a critical influence. Professional decisions on whether or not to implement technology in class thus has a significant impact on children's learning and development (Plowman & McPake, 2013). Research on educators of older children has also highlighted specific factors preventing the

later implementation of technology, such as: technology anxiety; lack of training; lack of efficient leadership; and more (Aldunate & Nussbaum, 2013; Palaiologou, 2016). However, there is limited research on the beliefs or attitudes of EC educators who work with children under three years of age in Australia and elsewhere.

Early years are fundamental for all areas of development (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2010) and the educator's role is crucial. The use of technology has attracted a lot of negative attention meaning that some educators may be hesitant to use technology with very young children. The present study contributes to our knowledge on EC educators' attitudes and beliefs regarding the use of touchscreen technology by very young children, while at the same time exploring various teaching philosophies and leadership issues. The terms 'educator' and 'teacher' are used interchangeably below to refer to practitioners within early childhood education (ECE). 'Very young children' are defined as those below the age of three years.

Research on factors impacting integration of technology into ECE

Studies have identified first-order extrinsic (or external) and second-order intrinsic (or internal) factors that influence teacher practices in terms of integrating technology into their classroom programs (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Lynch & Redpath, 2014).). External factors include access to technology, time to operate technology to build user confidence, professional development, training and support. Internal factors include teachers' pedagogical beliefs, whether they feel that children benefit from learning with technology, and their own confidence in using technology.

More recently, internal factors such as attitude and philosophy have been demonstrated to have an impact on how teachers integrate technology. Lynch and Redpath (2014) closely followed a teacher in her first year of practice and observed how technology was integrated into her classroom. In the beginning, she imitated her succeeding kindergarten teacher's practice and incorporated an iPad as part of literacy rotation groups where children played app games relating to literacy and used storybook apps. However, this did not match her personal teaching philosophy, which was more based on integrating technology in all areas of the curriculum and empowering her students to become autonomous learners (p. 159). In the following year she was driven by this philosophy to change the way iPads were incorporated into the teaching program. She wove the use of iPad into the literacy curriculum as a creative tool and, as a result, the children became the directors of their own literacy

learning. This study is a clear example of how a teacher's philosophy can directly affect how technology is integrated: a constructivist teacher views technology as a device, a tool to expand children's learning, rather than something to be used in a rote or drill/skill type activity.

Teachers and parents particularly worry about very young children's fine and gross-motor skills, language development, working memory, self-regulation, eyesight, future postural problems and other developmental issues (Bedford, Saez de Urabain, Cheung, Karmiloff-Smith, & Smith, 2016; O'Connor & Fotakopoulou, 2016). A growing number of studies has emerged in recent years examining the direct impact of such technologies on certain developmental areas (Bedford et al., 2016; Radesky, Silverstein, Zuckerman, & Christakis, 2014). Findings are positive for language and vocabulary development especially when adults are present and interact with babies and toddlers (e.g. Walter-Laager et al., 2016). However, more studies are required to encourage educators to see the positive outcomes of integrating technology within their programs.

Methodology

The study has two primary research questions:

- 1) What do early childhood educators and directors (leaders) believe about the use of touchscreen technologies by very young children (birth to three years of age);
- 2) What are the factors that influence educators' and directors' (leaders') attitudes and beliefs (e.g. social or personal beliefs; pedagogical values; digital literacy skills and more).

Conceptual framework

The project is underpinned by the ecological theory of Bronfenbrenner and Ceci (1994). This theory is consistent with EC philosophy (Bowes, Grace, & Hayes, 2012). The theory adopts a systemic approach, examining social phenomena through overlapping circular systems. However, this study only focused on the two inner systems: microsystem and mesosystem, as the ones directly connected with children and teachers.

As visually represented in Figure 1, factors that influence teachers' attitudes and beliefs are categorised inside the different systems. Starting from the inner circle, the 'microsystem' we explore teachers' personal characteristics and beliefs. Then the

‘mesosystem’ is explored with reference to workplace conditions, training, relationships with colleagues and leadership practices. Interrelationships between these two inner systems are finally discussed, including philosophical views, which are both personal and influenced by the sociocultural context.

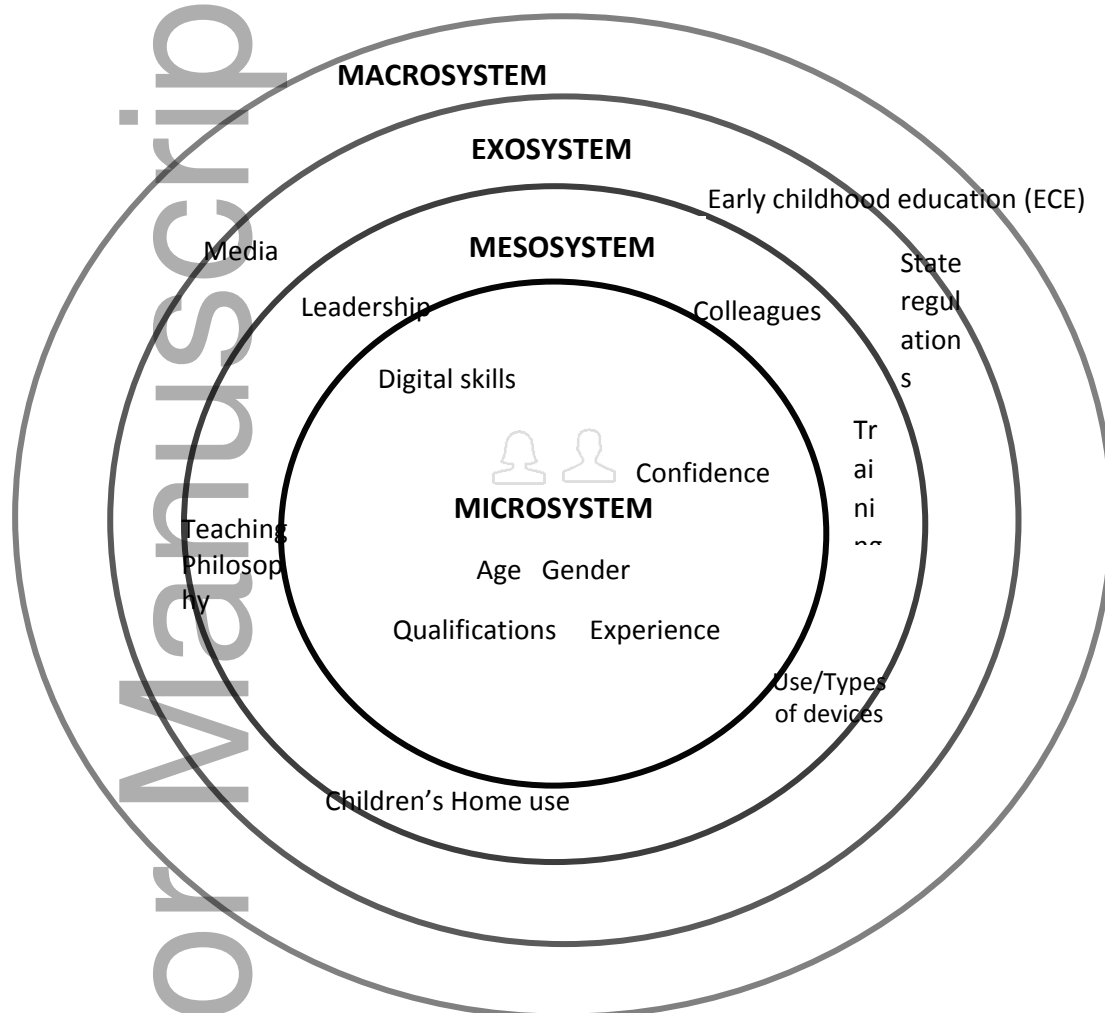


Figure 1: A visual representation of factors influencing educator beliefs based on Bronfenbrenner's ecological model.

Other researchers have used alternative categorisations. For example, Palaiologou's international study (2016, p. 5) on ECE teachers' dispositions towards digital devices in play-based pedagogy identified three key themes: task-behavioural orientation (tasks teachers complete with digital devices); emotional orientation (teachers' feelings towards digital devices); and coping orientation (teachers' intentions when using digital devices). Plumb and Kautz (2015, p. 11), in contrast, developed a tri-perspective framework for categorising the factors preventing the integration of technology in ECE. They presented three broad

perspectives impacting these factors: the ‘individualist’ (internal characteristics), the ‘structuralist’ (organisational characteristics) and the ‘interactive’ (technology integration seen as a process and the interrelationships between factors). While these previous attempts have significantly contributed to a deeper understanding of ECE teachers’ beliefs and attitudes towards technology, this study’s primary aim focuses on educators responsible for the youngest children at the earliest stages of technological engagement.

Participants

EC educators and directors who work, or have worked, with infants and toddlers in Australia completed the online survey ($N = 203$) and focus groups were also conducted to elaborate on their views ($n = 21$ educators; $n = 7$ directors/leaders). Participants for the focus groups were recruited from the university’s ECE centres (three centres) and also from the metropolitan areas of Sydney and Melbourne. Convenient sampling was adopted as it is common in small scale studies (Jonassen, 2004). The invitation to participate in the focus groups was included at the end of the survey, in the university website and in the Early Childhood Australia website (online advertisement). The only requirement to participate in the study was to have experience working with very young children. Ethical approval was obtained by the university and appropriate informed consent was sought from participants prior to advertising the survey/conducting the focus groups.

Measures and procedure

A detailed online survey and a semi-structured interview guide were employed. The survey was created with *Qualtrics* and had three main parts. Questions were both closed and open-ended with sub-questions depending on responses. Leaders and educators completed the same survey but leaders had six additional questions to answer.

In line with the first inner circle (Figure 1), the microsystem, the first part of the survey asked teachers:

- about their personal characteristics (age, experience etc);
- about their skills with technology. These were 37 statements, (e.g. ‘I feel confident in using a tablet device’; ‘I know how to upload files’; ‘I know how to create a video/movie’ etc) adapted from van Deursen, Helsper and Eynon’s (2014) questionnaire with permission; and

- about their confidence in the general use of technology, confidence in integrating technology with very young children and the reasons for their confidence ratings (e.g. overall, how confident would you consider yourself with using technology for personal/work reasons?).

The second part of the survey, in alignment with the second circle, the ‘mesosystem’ (Figure 1), included questions:

- about the use of technological devices and hours of use for personal/workplace reasons (e.g. digital technology you use in your workplace; how many hours per week you use this type of digital technology etc);
- about the technological devices/hours of use with very young children (e.g. do you use any of these technologies with infants or toddlers?);
- about leadership (e.g. do you think that your staff is generally supportive of the use of digital technology with young children?; do you think that your staff is generally confident with the use of technology with young children?); and
- about parents/home use (e.g. are you aware of whether your infants/toddlers are using any type of digital technology at home?; How do you know about what type of technology children are using at home?. The results from the home questions are not included in this paper as the focus is on educators).

Interrelationships between the different systems were explored in the third part of the survey, by including questions around teachers’ pedagogical approaches and views on children (e.g. five philosophical statements, Appendix B).

To further elaborate on attitudes and beliefs, focus groups with educators and directors were organised. Each focus group lasted from 40 to 65 minutes and was conducted in a university room or via Skype. Interviews were recorded and transcribed. Deductive analysis of each transcription followed and responses were first categorised into the six pre-existing themes emerging from the interview questions (ways of use, views on technology, reasons for views, impact of views, the future, other issues). Each theme and allocated responses were then reviewed by another researcher to ensure consistency. Common sub-themes in each larger theme were then merged.

Results

Data was entered in SPSS (v. 22) and frequencies and descriptive statistics were obtained. Anovas, correlations and regressions were performed also in SPSS to reveal statistically significant relationships between different factors in order to answer the second research question of the study.

Microsystemic factors and beliefs based on online surveys and focus groups

As expected, educators were mostly female and their age ranged from 30 to 60 years. Qualifications were relevantly high with the majority (72%) reporting a bachelor (university) degree or higher. The majority of teachers also had a substantial amount of experience within EC (81% had more than five years' experience) and with infants/toddlers (63% had more than five years' experience).

The digital skills statements were answered in a five-point Likert scale ('not at all true of me' to 'very true of me'). A total score was calculated ranging from 37 to 313. Overall, teachers rated themselves quite highly for their digital skills, with the majority having a total score of 213 (mean 182 and *SD* 90.6). In the questions regarding confidence in using technology for personal/workplace reasons, 73% rated themselves from seven to ten (ten was the highest score).

In contrast, the ratings for confidence in using technology with very young children were not as high. Only 32% of educators reported feeling confident enough (from seven to ten) to use technology with children under three years of age. The reasons behind this lack of confidence were a combination of both microsystemic and mesosystemic factors: teachers' personal belief that very young children should not use technology (51%); lack of training/knowledge/support/resources (30% to 49%); conflict with personal teaching philosophy (39%); and concern about harming children (39%). These results were also reflected in the focus groups. One of the teachers, E. explained: '...I just think it's the quality of what they're doing and their understanding of it. I guess the harder part is also the educators' understanding of it....we've got iPads now, like I said, that we can use, but how do we use them is what we need to look at, and making sure that they are used in a way that will benefit the children'. Another teacher referred to her personal feelings: 'I know that we don't use it but I feel like we are not meant to use it a lot. But that is just a feeling....'. Finally,

reasons relating to workplace conflicts, lack of interest, or parents being against the use of technology received much lower percentages (24%, 26% and 8% respectively).

Interviews revealed that concerns on technology and very young children gathered around development (maturation perspectives: e.g. ‘technology is better suited for older children, pre-schoolers, four or five year olds’) and on the impact of technology on social skills, relationships, language and brain development. One teacher even referred to ‘a stigma attached to technology that I feel like will eventually dissipate’ (by GMA) which reveals the negative extremes often presented by media. This result is consistent with previous studies reporting considerable concerns on behalf of teachers and parents about the long term impact of technology for very young children (O’ Connor & Fotakopoulou, 2016). The majority of teachers referred to the need for ‘setting limits’, ‘having a balance’, ‘being informed about the quality of tools’ and using technology in meaningful, purposeful and intentional ways to benefit children, extend their skills, explore information, create and not just play: ‘using technology as another branch of their learning’ (by M). But were also other teachers who were worried about: declining physical activity (‘it seems now the much more common thing is for a toddler to be able to use their smartphone than it is for a child to be able to climb’), promoting consumerism (‘they have become consumers of technology in a small amount of time’), using devices as a mere babysitting tool or causing addictive habits (e.g. ‘when they see a screen they are drawn to it regardless of what is on there’).

In regard to pedagogical approaches, moving closer to the mesosystem, teachers chose the ‘play-based approach to curriculum’ as their most often used approach (85%). This was followed by ‘caregiving’ (84%); ‘emergent approach’ (80%) ‘attachment’ (66%) and ‘developmental approach’ (64%). More than half also reported that they use ‘learning centres’ in their rooms very often (57%). The least frequent approach was ‘theme-based’ (25%).

Out of the five ‘philosophical’ statements, the one that resonated with most educators was that ‘children are young explorers/creators...and it is good for them to play with integrated, developmentally appropriate technology’ (74%). The second statement most consistent with teachers’ philosophies was the ‘young children have rights and educators have to respect these rights’ (53%). The traditional view of children as ‘innocent and in need of protection’ also resonated with 39% of educators. Similar percentages were reported by leaders (Table S1 - Appendix A).

The largest percentage of teachers reported that touchscreen technologies could be used for documenting learning (31%, e.g. taking photos when children are doing an interesting activity) and assessing learning (26%). Similar trends are observed in the leaders’

views (Table S1 - Appendix A). Finally, the majority of teachers were not sure whether their views on the use of technology by very young children would change in the future and only a small percentage (13%) gave a negative answer to this question.

Mesosystemic factors and beliefs based on online surveys and interviews

The technological devices used most frequently for personal reasons were smartphones (23 hours per week) followed by laptops (12 hours per week) and tablets (nine hours per week). Almost half of the centres surveyed have computers/laptops in each room (49%) as well as tablets (46%). Overall, digital cameras were the most popular tools with children under three, and were often used as an example of ‘appropriate’ technological practices with very young children (tablets were the second most popular tool and computers and electronic toys the third with very similar percentages – Appendix A, Table S1). All educators reported using devices sparingly with very young children: ‘less than five times a year’. Additionally, teachers reported that 90% of times at least one educator was with the children when they used any type of technology. This finding was expected given the very young age of children and the associated regulations of having at least one educator constantly present.

Less than half the teachers (36%) reported integrating technology ‘appropriately’ for this age group. However, when asked to explain what they meant/did in regard to integrating technology they provided some great examples. Most examples concentrated around the use of music/dancing/sounds/cultural music/lullabies (e.g. with the use of Spotify; iPods; YouTube) as well as videos/photos/projectors and stories. Examples including how the concept of the ‘metamorphosis of the butterfly’ was explored with the help of iPads or a project around frogs, provide evidence that integration of technology is possible and is happening with this age group.

In regard to training and professional development, many educators (65%) were not very satisfied with the amount of time nor the quality of training received in the last five years. The majority (88%) received less than 20 hours of training, which was mostly ‘technical’ (how to use one device). More importantly, in the last three years, 80% of educators claimed to have received no training in use of technology with infants/toddlers. The 20% of educators who had some training reported that it was focused on children from birth to five years with no specific focus on birth to three years — general guidelines on how to

limit screen time and increase playing outdoors, and the appropriate use of technology at home.

Descriptive statistics were also calculated for 58 participants with a leadership role (e.g. directors, room leaders, managers, etc) who completed the survey (out of the 203 participants in total); we use the term ‘leaders’ for this group of participants. Most of them were highly qualified, very experienced and quite confident in their personal use of technology, although not in the context of very young children (see Table S1 in Appendix A). While they did not think they had had a lot of training, most of them were satisfied with the training they did receive. Pedagogical beliefs and philosophies were also quite similar between educators and leaders. Importantly, almost half (49%) of the leaders reported that educators were supportive of the use of technology within their centres, although a significant percentage (22%) were not sure. Similarly, almost half of the leaders reported that educators are ‘open to the idea of incorporating technology in their rooms’ (48%, do not know: 22%). They also elaborated on some factors that may prevent educators from incorporating technology. Most referred to microsystemic reasons such as: ‘I believe it is not appropriate’; ‘It is detrimental for brain development’; ‘Other activities are more important’; ‘Children learn via play with real equipment and real people’; ‘We value play and hands on self-discovery’; and similar. They also mentioned mesosystemic reasons: the lack of training, resources, knowledge and research; and the use of technology being against the centre’s policy or not favoured by families.

Less than half of leaders (47%) believed that educators are not very confident in the use of technology with very young children in their setting and only 10% of leaders were not sure what to report on this question. This result, although not exactly the same as what all participants reported, demonstrates that leaders have overall a more positive view on educators’ competencies.

Teachers and leaders also underlined the importance of having a clear set of guidelines or a written policy on the use of technology for parents, children and themselves in their workplace.

... within our service, if we are going to use technology with children I think we need to have the policy and the work practice about what is appropriate with young children... (by Sam)

Interrelationships between systems — beliefs based on online surveys

This section includes the analyses with different microsystemic and mesosystemic variables. Demographic data were analysed first (microsystem). ANOVAs between subjects and correlations were performed to examine any possible effect of age, academic qualifications, years of experience and workplace position on two dependent variables: digital skills and hours of technology use at workplace. The variable of gender was not investigated as the ratio between males and females was not balanced (Dancey & Reidy, 2002). No significant effect of any factor on digital skills or hours of technology use at workplace was found.

The score from the digital skills was significantly associated with the hours of technology use with children and the number of types of technology EC educators use.

The two-tailed Pearson's r analysis between the factor of digital skills and the hours of technology use outside work/hours of technology with children revealed an $r = .395$ moderate correlation coefficient between the scores. The associated probability level ($p < .001$) indicated that these results were unlikely to have arisen by sampling error. Also, a Pearson's r analysis between the factor of digital skills and the number of types of technology used in the workplace revealed $r = .415$, moderate with associated probability level ($p < .001$). The moderate correlations were further investigated with regression analyses. Linear regression analysis revealed that digital skills are correlated with the hours of technology use with children. Confidence limits were 95% and the slope was between 4.208 and 6.353. The F-value (94.314, $DF = 1,184$) had an associative probability level of $p < .001$. Linear regression analysis also revealed that digital skills are correlated with the number of types of technology use with children. Confidence limits were 95% and the slope was between 4.198 and 5.983. The F-value (19.546, $DF = 1,184$) had an associative probability level of $p < .001$.

Training in the use of technology with children was significantly associated with educators' confidence in how to integrate technology in their everyday practice.

Two-tailed Pearson's r analysis between the factor of hours of technology use with children and hours of technology training (for use with children)/satisfaction with technology training revealed a non-significant correlation. Two-tailed Pearson's r analysis between the types of technology use and the hours of training revealed $r = .375$ moderate with associated probability level ($p < .001$). A moderate correlation was also observed between the hours of technology training and confidence in technology use with children with $r = .411$ ($p < .001$).

Linear regression analysis revealed that hours of training correlated with the types of technology use with children. Confidence limits were 95% and the slope was between 3.104 and 5.373. The F-value (1.184, $DF = 1,184$) had an associative probability level of $p < .001$. Linear regression analysis also revealed that hours of training correlated with confidence in technology use with children. Confidence limits were 95% and the slope was between 4.324 and 6.574. The F-value (1.583, $DF = 1,184$) had an associative probability level of $p < .05$.

Digital skills score and hours of using technology with children were significantly associated with EC educators' responses to the teaching philosophy statements.

Teachers' approaches to curriculum were correlated with digital skills and hours of technology use with children. Both correlations were non-significant. Participants' responses to the five philosophical statements and the hours of technology use outside work were also non-significant. Participants' responses to the five statements were significantly correlated with digital skills and hours of technology use with children. Linear regression analyses revealed that teachers' responses to the philosophical statements were significantly associated with the digital skills score and also the hours of technology use with children (details in Appendix B).

Teachers also underlined the importance of teaching philosophies in their interviews:

I think there will definitely be a link between your teaching philosophy and your use of technology. Because if you are like maybe someone that really values that prescriptive type of learning might use an iPad as a teaching tool, not as an open-ended resource. They might have like, I have seen applications where it is like, "Let's learn new letters and numbers and let's count how many blue fish are here." Like those sorts of apps that are really specific.So, I think that depending on the way in which you value learning and how you learn would definitely impact the way in which you use technology day-to-day. (by Mel)

It is evident from this quote that EC teachers have strong personal views on how children learn. These views are important elements of their teaching philosophy and as

revealed in this study (74% of educators believed children are ‘explorers and creators’) also important elements of incorporating technology in everyday practice. Open-ended approaches are highly valued in ECE and teachers would appreciate these type of approaches to be more strongly embraced by new technologies together with tailored to their needs training.

Discussion

This Australian study focuses on ECE teachers’ attitudes and beliefs around the use of technology with very young children. Although the gap in the literature review is unquestionable and more work is required to investigate the exosystems and macrosystems, this study offers a significant transformation in our knowledge about EC educators. It reveals a changing trend in views on the use and integration of technology from a very young age. Consistent with recent reports (Kerckaert, Vanderlinde, & van Braak, 2015; Palaiologou, 2016) teachers in this study were found to be more confident in their personal use of technology and more open to change.

EC teachers are now using technology every day and many of them are open to the possibilities of using it with the youngest of our children. Teachers in this study were also well informed regarding what integration of technology means with young children in particular. The majority of them see very young children as ‘young explorers’ and ‘creators’, they resist the passive nature of technological engagements and they value children’s rights. However, as previously reported by Palaiologou (2016), they are not as convinced about the involvement of technology in play and how new touchscreen technologies could potentially enhance children’s free play, a core value of ECE.

As personal use and engagement with technology increases teachers’ confidence in their digital skills also grows. Training and professional development is an important mesosystemic factor, but what is more important is the need to tailor training to teachers’ everyday needs and interactions with very young children, as clearly indicated by the findings of this study. In contrast, leadership considerations, although important (Ertmer et al., 2012), were not found to be a decisive factor. Teachers and leaders shared very similar views and seem to work in harmony and no problems were identified which could prevent teachers from using technology in their rooms. Technology provides rich opportunities for teachers (including leaders) to collaborate and learn from each other and one possible reason for this

is that in EC centres democratic and distributional styles of leadership are encountered (Rodd, 2012). Overall, leadership was not found to significantly improve or 'harm' the use of technology in EC centres, but the number of questions was limited and further research may concentrate on this topic to shed more light in this area. Macrosystemic factors, such as legislation, state regulations for ECE settings (e.g. very young children are not to be left alone at any point), teachers' leadership courses etc were not explored in this study, and it would be useful for them to be taken into account in future research.

An innovative element of this study was the focus on pedagogical approaches and philosophical views associated with children. However, the questions were limited. Results are mixed but there is a definite link between educators' view regarding children and their personal use of technology. When children are viewed as explorers and creators an emphasis is placed on whatever can facilitate their investigations/experimentations. Even very young children are seen as having their own rights and not just needs. Given the statistically significant results of this study, we would suggest that additional work in this area is imperative to further elaborate on teachers' views around how children learn best and what they consider 'creative', 'developmentally appropriate', 'explorative' etc in regards to technological use. In combination with the need for more holistic training, it would be useful to see whether work on teaching philosophies first and then technological training could be effective for EC teachers.

Older reports suggesting that EC educators are falling behind, and 'missing the boat' with technology (Parette, Quesenberry, & Blum, 2010) seem outdated now. Instead, teachers are sceptical and critical of which one is the 'right boat' for very young children. Given that this is a critical age for all aspects of development and that technology is an undeniable part of everyday life for these children and will be even more eminent as they grow up, educators are concerned about how to establish a 'positive start' in using technology. Research has shown that 'problematic media habits may predict a trajectory of increasingly excessive use through adolescence' (Radesky, et al., 2014, p. 1176) and therefore the early years are fundamental. EC educators carry a heavy responsibility as the first teachers children encounter outside the home. EC educators are not rejecting technology, rather they need more training, support, knowledge and research. Future, multidisciplinary and longitudinal research around the impact of technology on young children's brain, language and other areas of development is crucial as highlighted by teachers not only to alleviate concerns and eliminate 'the stigma' but also to help them embrace the future and integrate more technology in their practice in a way that is beneficial for this age group.

Conclusions — Implications

This study has advanced our knowledge on what is happening in ECE settings in Australia.

More research is imperative and future studies could:

- prioritise investigating very young children's perspectives and how they use new technologies;
- design longitudinal projects following holistic, ecological approaches and outcomes of young children's use of touchscreen technologies are examined with contemporary methods (e.g. brain research);
- examine EC leadership perspectives and initiatives; professional development models; policy documents and regulations on the use of technology for very young children (exosystemic and macrosystemic factors); and
- investigate parental beliefs and routines around the use of technology at home and cultural effects.

The findings of this study may also contribute towards building stronger, more equitable, ethical and inclusive communities where all children's rights are respected and supported and where educators feel empowered to introduce pedagogical transformations. Findings can inform future educational policies and teacher education programs. Government reports around digital literacy have to be inclusive and carefully consider the needs/requirements of *all* teachers.

Statements on ethics, open data and conflict of interest

The study has ethics approval from Macquarie University. Data from the survey and the interviews are available for review. Authors will retain data for five years as per University guidelines.

Permission to access the data can be provided through the Ethics committee of Macquarie University.

Pseudonyms have been used throughout the paper to ensure confidentiality and anonymity. No conflict of interest to declare.

References

- Ahearne, C., Dilworth, S., Rollings, R., Livingstone, V., & Murray, D. (2015). Touch-screen technology usage in toddlers. *Archives of Disease in Childhood*, 101, 181–183. doi: 10.1136/archdischild-2015-309278
- Aldunate, R., & Nussbaum, M. (2013). Teacher adoption of technology. *Computers in Human Behavior*, 29(3), 519–524. doi: <http://dx.doi.org/10.1016/j.chb.2012.10.017>
- Bedford, R., Saez de Urabain I. R., Cheung, C. H. M., Karmiloff-Smith, A., & Smith, T. J. (2016). Toddlers' fine motor milestone achievement is associated with early touchscreen scrolling. *Frontiers in Psychology*, 7. doi: 10.3389/fpsyg.2016.01108
- Bowes, J., Grace, R., & Hayes, A. (2012). The role of Context in Children's Development. In J. Bowes, R. Grace & K. Hodge, (Eds.) *Children, families and communities: Contexts and consequences* (pp. 3–17). Melbourne: Oxford University Press.
- Bronfenbrenner, U., & Ceci, S. J. (1994). Nature-nurture reconceptualized in developmental perspective: A bioecological model. *Psychological Review*, 101(4), 568–586.
- Christakis, D. A. (2014). Interactive media use at younger than the age of 2 years: Time to rethink the American Academy of Pediatrics guideline? *JAMA Pediatrics*, 168(5), 399–400. doi: 10.1001/jamapediatrics.2013.5081
- Dancey, P., & Reidy, J. (2002). *Statistics without maths for psychology*. Edinburgh: Prentice Hall.
- Ertmer, P. A., Ottenbreit-Leftwich, A.T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education*, 59, 423–435. doi: 10.1016/j.compedu.2012.02.001
- Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting Education in “Educational” Apps: Lessons From the Science of Learning. *Psychological Science in the Public Interest*, 16(1), 3–34.
- Holloway, D. J., Green, L., & Stevenson, K. (2015). Digitods: Toddlers, touch screens and Australian family life. *M/C Journal*, 18(5). Retrieved 23 August 2016 from www.journal.media-culture.org.au/index.php/mcjournal/article/view/1024
- Jonassen, D. D. (2004). *Handbook of Research on Educational Communications and Technology* (2nd ed.). London: Lawrence Erlbaum Associates.

- Kabali, H. K., Irigoyen, M. M., Nunez-Davis, R., Budacki, J. G., Mohanty, S. H., Leister, K. P., & Bonner, R. L. (2015). Exposure and use of mobile media devices by young children. *Pediatrics*, 136(6), 1044–1050. doi: 10.1542/peds.2015-2151
- Kerckaert, S., Vanderlinde, R., & van Braak, J. (2015). The role of ICT in early childhood education: Scale development and research on ICT use and influencing factors. *European Early Childhood Education Research Journal*, 23(2), 183–199.
- Lynch, J., & Redpath, T. (2014). ‘Smart’ Technologies in early years literacy education: A meta-narrative of paradigmatic tensions in iPad use in an Australian preparatory classroom. *Journal of Early Childhood Literacy*, 14(2), 147–174. doi: 10.1177/1468798412453150
- O’Connor, J., & Fotakopoulou, O. (2016). A threat to childhood innocence or the future of learning? Parents’ perspectives on the use of touch-screen technology by 0–3 year-olds in the UK. *Contemporary Issues in Early Childhood*, 17(2), 235–247. doi:10.1177/1463949116647290
- Palaiologou, I. (2016). Teachers’ dispositions towards the role of digital devices in play-based pedagogy in early childhood education. *Early Years*, 36(3), 305–321.
- Parette, H. P., Quesenberry, A. C., & Blum, C. (2010). Missing the boat with technology usage in early childhood settings: A 21st century view of developmentally appropriate practice. *Early Childhood Education Journal*, 37(5), 335–343.
- Plowman, L., & McPake, J. (2013). Seven myths about young children and technology. *Childhood Education*, 89(1), 27–33.
- Plumb, M., & Kautz, K. (2015). Innovation determinants and barriers: A tri-perspective analysis of IT appropriation within an early childhood education and care organisation. *Australasian Journal of Information Systems*, 19, 1–22. doi: 10.3127/ajis.v19i0.1209
- Radesky, J. S., Silverstein, M., Zuckerman, B., & Christakis, D. A. (2014). Infant self-regulation and early childhood media exposure. *Pediatrics*, 133(5), e1172–e1178.
- Rintakorpi, K., Lipponen, L., & Reunamo, J. (2014). Documenting with parents and toddlers: A Finnish case study. *Early Years*, 34(2), 188–197.
- Rodd, J. (2012). *Leadership in early childhood*. UK: McGraw-Hill Education.
- Strasburger, V. C., Hogan, M. J., Mulligan, D. A., Ameenuddin, N., Christakis, D. A., Cross, C., ... & Moreno, M. A. (2013). Children, adolescents, and the media. *Pediatrics*, 132(5), 958–961.

- Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (Eds.). (2010). *Early childhood matters: Evidence from the effective pre-school and primary education project*. London: Routledge.
- van Deursen, A. J., Helsper, E., & Eynon, R. (2014). *Measuring digital skills: From digital skills to tangible outcomes*. Retrieved 5 January 2018 from http://doc.utwente.nl/92924/1/Measuring_Digital_Skills.pdf
- Walter-Laager, C., Brandenburg, K., Tinguely, L., Schwarz, J., Pfiffner, M. R., & Moschner, B. (2016). Media-assisted language learning for young children: Effects of a word-learning app on the vocabulary acquisition of two-year-olds. *British Journal of Educational Technology*, 48(4), 1062–1072.